

## CLAIMS

1. An apparatus for performing a process for reducing to metallic form metal oxides, the said metal oxides comprising metal oxides present in spent nuclear fuel, wherein the apparatus comprises an electrochemical cell which comprises a body or housing, a cathode container, and a cathode connector, said body or housing being maintained as the cathode, and said electrochemical cell being free from bolted or screwed fittings.
2. An apparatus as claimed in claim 1 wherein said cathode connector is affixed to an internal surface of the cell.
3. An apparatus as claimed in claim 2 wherein said cathode connector is affixed to an internal surface of the cell by means of welding.
4. An apparatus as claimed in any one of claims 1, 2 or 3 wherein an electrical connection from the cathode container to the body or housing of the cell is provided by means of a cathode connector.
5. An apparatus as claimed in claim 4 wherein said electrical connection is provided by means of a press connection.
6. An apparatus as claimed in any preceding claim wherein said cathode connector comprises a cathode rail.
7. An apparatus as claimed in claim 6 wherein said rail is welded to the base of the cell.
8. An apparatus as claimed in any preceding claim wherein the cathode container comprises a mesh basket or metal oxide retaining vessel.

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9. An apparatus as claimed in any preceding claim wherein the cathode container comprises an assembly of cathode containers.
- 5 10. An apparatus as claimed in claim 9 wherein said assembly comprises an assembly of mesh baskets or metal oxide retaining vessels.
11. An apparatus as claimed in any preceding claim wherein the anode is a carbon anode.
- 10 12. An apparatus as claimed in any preceding claim wherein the body or housing of the cell is maintained as the cathode by the provision of an electrical connection from a power supply to the body or housing of the cell.
- 15 13. A process for reducing to metallic form metal oxides, the said metal oxides comprising metal oxides present in spent nuclear fuel, the process comprising cathodically electrolysing the oxide in the presence of a molten salt electrolyte in an apparatus as claimed in any one of claims 1 to 12, the potential of the cathode being controlled so as to favour oxygen ionisation over deposition of metal from the cations present in the molten salt.
- 20 14. A process as claimed in claim 13 wherein the body or housing of the cell is maintained as the cathode and is brought into contact with the cathode container by means of a press connection between said container and a cathode connector.
- 25 15. A process as claimed in claim 13 or 14 wherein the oxide comprises the oxide of zirconium or hafnium.
- 30 16. A process as claimed in any one of claims 13 to 15 wherein the oxide comprises an actinide oxide.

17. A process as claimed in claim 16 wherein the actinide oxide comprises uranium oxide, irradiated uranium oxide or mixed uranium/plutonium oxide fuel pellets.
- 5 18. A process as claimed in claim 17 wherein the uranium oxide comprises uranium dioxide.
19. A process as claimed in any one of claims 13 to 18 wherein the oxide is located in a mesh basket which forms the cathode.
- 10 20. A process as claimed in any one of claims 13 to 19 wherein the molten salt electrolyte comprises at least one chloride salt.
21. A process as claimed in claim 20 wherein the chloride salt is  $\text{CaCl}_2$  or  $\text{BaCl}_2$ .
- 15 22. A process as claimed in any one of claims 13 to 21 wherein the fuel is treated together with its cladding.
23. A process as claimed in any one of claims 13 to 21 wherein the cladding is removed from the fuel prior to treatment.
- 20 24. A process as claimed in any of claims 13 to 23 wherein the metal resulting from the process is used as the feed for an electrorefining process.
- 25 25. A process as claimed in claim 24 wherein the electrorefining process is carried out in the same electrolytic cell as the electrolytic reduction process.